Missouri Department of Natural Resources

Engineering Report Guidance for Collection Systems with a Design Flow of 22,500 gpd or Greater

Water Protection Program fact sheet 9/2011

This document provides engineering consultants a comprehensive guide of the Missouri Department of Natural Resources' recommendations and requirements for an approvable engineering report for facilities with a design flow of 22,500 gallons per day, or gpd, or greater.

Engineering reports shall be completed for projects involving collection systems (e.g., gravity sewers, pressure sewers, pumping stations and force mains). See 10 CSR 20-8.110(4)(A)4 and 10 CSR 20-8.110(4)(B).

Engineering reports do not have to be submitted for projects limited to only 8-inch gravity sewer extensions, unless required by the department. See 10 CSR 20-8.110(4)(A)4.A.

Wastewater treatment facility projects and projects receiving funding from the department under 10 CSR 20-4 require a facility plan. See 10 CSR 2-8.110(4)(A)4. Facility plans are more extensive and detailed documents compared to engineering reports.

Until 10 CSR 20-8.020 can be amended, 10 CSR 20-8.110 shall apply to all facilities with a design flow of 22,500 gpd or greater. 10 CSR 20-8.110 shall apply to all facilities with a design flow of 100,000 gpd or greater after 10 CSR 20-8.020 is amended.

Engineering reports must be approved by the department prior to the submittal of plans and specifications, construction permit application and associated fee(s).
See 10 CSR 20-8.110(3)(C).

The following is a sample format for the required engineering report content:

Title Page
Include the following:

- Name of the project.
- Owner of the system.
- Contact information.
- Date of the submittal.
- Missouri registered professional engineer seal, signature and date.
  See 10 CSR 20-8.110(3)(D).

Table of Contents
Identify the headers, figures, tables and appendices locations.

Introduction
State the purpose for the project. Describe the existing system, including an evaluation of the existing conditions and problems needing correction. Include any schedules of compliance, enforcement administrative orders or agreements. See 10 CSR 20-8.110(4)(B)1.

Planning and Service Area
Identify the planning area, the existing and potential future service area, the site of the project, anticipated location and alignment of proposed facilities on a map or sketch.

Population Projection and Planning Period
Base the present and predicted population on a 20 year planning period. Sewers and other facilities with a design life in excess of 20 years shall be designed for the extended period.

Hydraulic Capacity Determination
For consistency, use the following flow definitions as a basis for the design of sewers, pumping stations, wastewater treatment facilities, treatment units and other wastewater handling facilities. See 10 CSR 20-8.110(4)(C)4.A.

- **Design average flow** – The design average flow is the average of the daily volumes to be received for a continuous 12 month period expressed as a volume per unit time. However, the design average flow for facilities having critical seasonal high hydraulic loading periods (e.g., recreational areas, campuses and industrial facilities) shall be based on the daily average flow during the seasonal period.
- **Design maximum daily flow** – The design maximum daily flow is the largest volume of flow to be received during a continuous 24 hour period expressed as a volume per unit time.
- **Design peak hourly flow** – The design peak hourly flow is the largest volume of flow to be received during a one hour period expressed as a volume per unit time.
- **Design peak instantaneous flow** – The design peak instantaneous flow is the instantaneous maximum flow rate to be received.

Existing Systems
Flow projections for the design life of the system shall be made using actual flow data to the extent possible. Evaluate the probable degree of accuracy of data and flow projections. This reliability estimation shall include an evaluation of the accuracy of existing data, based on no less than one year of data. Also, provide an evaluation of the reliability of estimates of flow decreases anticipated due to inflow/infiltration, or I/I, reduction or flow increases due to elimination of sanitary sewer overflows, or SSOs, and basement backups. Include critical data and methodology. Graphical displays of critical peak wet weather flow data shall be included for a sustained wet weather flow period of significance to the project.
See 10 CSR 20-8.110(4)(C)4.B.

New Systems
New sewer systems and wastewater treatment facilities shall be based on an average daily flow of 100 gpd per capita. Also, consider flow from industrial facilities and major institutional and commercial facilities. However, an alternate flow based on water use data or other justification, which better estimates flow, may be provided. See 10 CSR 20-8.110(4)(C)4.C.(I).

The peaking factor, determined by Figure 1 in 10 CSR 20-8.110(4)(C)4.C.(II), shall be multiplied by the projected design average flow to determine the peak hourly flow. The peaking factor accounts for normal infiltration for collection systems built with modern construction techniques. See 10 CSR 20-8.110(4)(C)4.C.(II).

If the new collection system is to serve an existing development, the likelihood of I/I contributions from existing service lines and non-wastewater connections to those service lines shall be evaluated. Wastewater treatment facilities shall be designed accordingly to account for these additional flows. See 10 CSR 20-8.110(4)(C)4.C.(III).

Combined Sewer Interceptors
Interceptors for combined sewers shall have the capacity to receive sufficient quantity of combined wastewater for transport to wastewater treatment facilities to ensure attainment of the appropriate water quality standards. See 10 CSR 20-8.110(4)(C)4.D.

Organic Capacity Determination
For consistency, use the following organic load definitions as a basis for the design of wastewater treatment facilities. See 10 CSR 20-8.110(4)(C)5.A.

- **Biochemical Oxygen Demand** – The five day Biochemical Oxygen Demand, or BOD_5, is defined as the amount of oxygen required to stabilize biodegradable organic matter under aerobic conditions within a five day period.
- **Total five day Biochemical Oxygen Demand, or $TBOD_5$** – $TBOD_5$ is equivalent to BOD_5 and is sometimes used in order to differentiate carbonaceous plus nitrogenous oxygen demand from strictly carbonaceous oxygen demand.
- **Carbonaceous five day Biochemical Oxygen Demand or $CBOD_5$** – $CBOD_5$ is defined as BOD_5 less the nitrogenous oxygen demand of the wastewater.
- **Design average BOD_5** – The design average BOD_5 is generally the average of the organic load received for a continuous 12 month period for the design year expressed as weight per day. However, the design average BOD_5 for facilities having critical seasonal high loading periods (e.g., recreational areas, campuses and industrial facilities) shall be based on the daily average BOD_5 during the seasonal period.
- **Design maximum day BOD_5** – The design maximum BOD_5 is the largest amount of organic load to be received during a continuous 24 hour period expressed as weight per day.
- **Design peak hourly BOD_5** – The design peak hourly BOD_5 is the largest amount of organic load to be received during a one hour period expressed as weight per day.

Existing Systems
Projections shall be made from actual wasteload data to the extent possible. Evaluate the probable degree of accuracy of data and wasteload projections. Impacts of industrial sources shall be documented. See 10 CSR 20-8.110(4)(C)5.B.

New Systems
Domestic wastewater treatment design shall be based on at least 0.17 pounds of BOD_5 per capita per day and 0.20 pounds of suspended solids per capita per day, unless information is submitted to justify alternate designs. Impacts of industrial sources shall be documented. See 10 CSR 20-8.110(4)(C)5.C.

Project Development

Project Description

Provide a description of the proposed project. See 10 CSR 20-8.110(4)(B)4.

Site Evaluation

Provide the following project site information: topography, soils, geologic conditions, depth of bedrock, groundwater level, floodway or floodplain considerations, distance to water supply structures, roads, residences and other pertinent site information. See 10 CSR 20-8.110(4)(B)7.

Design Criteria

Provide the design criteria and calculations used to determine design flow, velocity, pipe size and all pumping station calculations, including energy requirements. Indicate whether special accessories and stream crossings are incorporated in the proposed project.
See 10 CSR 20-8.110(4)(B)6.

Technical Information

Identify any unusual specifications, construction materials and construction methods used in the proposed project. Include any maps, photographs, diagrams and other supporting data needed to describe the system. See 10 CSR 20-8.110(4)(B)6.

Impact of Existing Facilities

Evaluate the impact of the proposed project on all existing wastewater facilities, including sewers, pumping stations and wastewater treatment facilities. See 10 CSR 20-8.110(4)(B)3.

Flood Protection

Pumping stations design must take into consideration flood protection. The station should remain fully operational and accessible during a 25 year flood. Station structures, electrical and mechanical equipment shall be protected from damage during a 100 year flood.
See 10 CSR 20-8.130(3)(A).

Emergency Operations

Discuss emergency operation requirements for pumping stations in accordance with 10 CSR 20-8.130.

Deviations from 10 CSR 20-8

If this project contains known deviations from 10 CSR 20-8, submit the documentation and justification for the deviation. Note that many deviations are common while others are reviewed on a case-by-case basis. See 10 CSR 20-8.110(4)(B)8.

Cost Estimate

Cost estimates for capital and operation and maintenance should be included.

Drawings

Provide a system map (report size). See 10 CSR 20-8.110(4)(B)6. Include drawings or sketches identifying the site of the project, anticipated location and alignment of the proposed facilities. See 10 CSR 20-8.110(4)(B)5.

For More Information

Missouri Department of Natural Resources
Water Protection Program
P.O. Box 176
Jefferson City, MO 65102-0176
800-361-4827 or 573-751-1300
www.dnr.mo.gov/env/wpp